

third as long as the spikelet, and the second glume is about one-half the spikelet length; the fertile lemma is strongly gibbous, transversely rugose below, becoming smooth and shiny at the apex.

In 1962 (Illinois Biol. Monogr. 29, p. 44.), J. M. Rominger described a variety, *antrorsa*, of *Setaria tenax*. He indicated the type locality as Chichén Itzá, Yucatán, Mexico, citing *Swallen 2439*, with specimens deposited at both MO and US, but did not designate either of the specimens as the holotype. He noted that his new variety differed from var. *tenax* solely in having only antrorse barbs on the awns, with no retrorse barbs present. Var. *antrorsa* is known from the Mexican states of Yucatán, Veracruz, and Chiapas, as well as Honduras (R. W. Pohl, *Flora Mesoamericana* 6: 360, 1994).

The US specimen of *Swallen 2439* was examined as part of a study comparing some North and South America taxa to verify the occurrence of certain species in both hemispheres. It was noticed immediately that Rominger had never annotated the sheet, and this had been noted on the specimen by D. H. Nicholson. The US folder is labeled "possible isotype". The MO specimen also has no annotation by Rominger. The MO sheet was annotated as an isotype by G. Davidse, who may have simply assumed that the holotype was at US. Pohl (*l.c.*), who seems to be the only author to deal with var. *antrorsa* since Rominger, states the following: "Holotipo: Mexico, Yucatán, *Swallen 2439* (US!)." Pohl is obviously incorrect here, since Rominger himself did not select the US specimen as holotype, and, moreover, listed MO ahead of US in citing the type specimens. How Pohl came to consider the US specimen to be the holotype is a mystery. Rominger, in a recent conversation, told me that he had never had any discussion with Pohl regarding var. *antrorsa*, and encouraged my selecting a lectotype. Pohl's published citation, left uncorrected, constitutes a potential source of confusion.

Article 9.9 of the Tokyo Code (1994) provides for the lectotypification of a taxon where a holotype is not designated in the original protologue. Lectotypification of *Setaria tenax* var. *antrorsa* is therefore proposed here.

The MO and US specimens of var. *antrorsa* are not of equal quality. The US sheet has a single culm with an immature panicle. The young spikelets are not mature enough to exhibit adequately the *Setaria tenax* characters given above. The MO specimen, in contrast, has two mature panicles in which the spikelets are well-developed and typical of the species. Because the latter specimen clearly better represents the species, and because Rominger cited the MO specimen first in his protologue, I designate *Swallen 2439* at MO (sheet No. 1043993) as the lectotype of *Setaria tenax* var. *antrorsa*; the US specimen (sheet No. 3090500) then becomes the isolectotype.

REPRODUCTIVE RESPONSE TO FIRE BY THE LAUREL SUMAC, *MALOSMA LAURINA* (ANACARDIACEAE).—Gary B. Perlmutter, 151 N. Lomita Avenue, Ojai, CA 93023.

One of the adaptations perennial plants have to an environment with frequent fires or other stresses is the ability to sprout from surviving structures within the soil after the aerial portions have been destroyed by the disturbance. These subterranean features include rhizomes, bulbs, and undamaged root crowns. Many such fire resistant species produce flowers either immediately following or more than two years after the plant is burned (Gill, Fire and the Australian Biota, Australian Academy of Science, Canberra, 1981; Platt et al., *Oecologia* 76:353–363, 1988).

Malosma laurina (Nutt.) Abrams (laurel sumac) is a facultative resprouter (Saruwatari and Davis, *Oecologia* 80:303–308, 1989) with year-round growth in coastal environments of southern California (Watkins and de Forest, *Ecology* 22:79–83, 1941). While its growth patterns and seedling survivorship following fire disturbance have been studied (Thomas and Davis, *Oecologia* 80:309–320, 1989), the repro-

ductive effects of this species have been overlooked. Is flowering hindered by vegetative growth in burn recovery or do plants flower the following summer regardless of canopy damage by a recent fire? The data presented here aim to answer this question.

Phenological patterns of inflorescences of burned and unburned sumacs were studied in habitats of similar climate along coastal slopes of the Santa Monica Mountains (34°05'N, 119°02'W) in southeastern Ventura County. The climate is of the South Coast Thermal Belt with mild winters and summer heat modified by marine influence (Hickman, *The Jepson manual: higher plants of California*, University of California Press, 1993). One of these sites was burned by the Green Meadow Fire in October 1993 while two others were spared by the fire. Reconnaissance of the area for site selection in November 1994 revealed sprouting shrubs about 1 m tall scattered throughout a successional grassland except for a few patches of unburned coastal sage scrub where large *M. laurina* shrubs flourished. Site descriptions are as follows:

The burned site lies at the Mugu Peak trailhead at the base of a southwest-facing slope at 6 m elevation. The plant community was a successional grassland dominated by *Nassella* sp., *M. laurina*, and *Malacothamnus fasciculatum*. The soil was a pebbly loam with a water capacity of 0.43 cm/cm. *Malosma* shrubs were stump-sprouting, with conspicuous burnt branches extending beyond the living canopies. Down the coast, 4 km ESE from this site is the site Unburnt 1. Also at 6 m elevation, it lies at the base of a south-facing slope just east of La Jolla Canyon. The community is Diegan Coastal Sage Scrub (Holland, Preliminary descriptions of the terrestrial natural communities of California, California Department of Fish and Game, 1986) dominated by *Artemisia californica*, *M. laurina*, and *Salvia mellifera*. *Malosma* canopies were interwoven to form a nearly continuous horizontal band at that altitude for 1 km. The soil is a fine sandy/silty loam with blocky talus and 0.13 cm/cm water capacity. The site Unburnt 2 lies 8 km ESE of the burned site, along Deer Creek Rd at 150 m elevation on a northeast-facing slope. This was in a low, 1 m high chaparral dominated by *Lotus scoparius*, *Ceanothus megacarpus*, and *M. laurina*. Although the community structure and composition suggests second-year fire succession (McAuley, *Wildflowers of the Santa Monica Mountains*, Canyon Publishing Co., 1985), study shrubs showed no fire damage. The soil was a gravelly loam with 0.46 cm/cm water capacity.

At each site, five representative individuals at least 2 m tall were selected for study and marked with flagging. Beginning in May 1995, sites were visited weekly to record the presence and condition of inflorescences at each plant. Panicle condition was classified and ranked into the following stages: growing buds (1), mature buds (2), and flowers (3). The growing bud stage is characterized by a reddish color and small size; the mature bud stage exhibits greenish, pinkish or whitish color and larger size. Each plant canopy was divided into four sections (north, east, south, and west faces) to bring the sample size to 20 per site; in each section I recorded the stages panicles were observed in.

From the data, onset and peak dates of each stage were determined and compared among sites, as were flower development periods (D_{F1}), which is here defined as the number of weeks from the date of first buds observed to the date when at least 50% of a population is in flower (Bowers, *Madroño* 43(1):69–84). Stage onset dates of each shrub were further compared to assess within-site variation.

Burned shrubs showed no panicles from previous seasons, whereas inflorescences were abundant on unburned plants. Onset and peak dates of bud and flower stages were up to 5 wk later among burned shrubs (Fig. 1); however, D_{F1} was 8 wk in each site.

Within sites, onset dates of individual shrubs varied 1–4 wk (Fig. 2). In the burned site, this variance for the growing bud, mature bud and flower stages are 4, 3, and 1 wk, respectively; in Unburnt 1 these are 1, 4, and 4 wk; and in Unburnt 2 they are 2, 4, and 3 wk.

In the burned site, *Malosma laurina* resprouters did not produce flowers until two

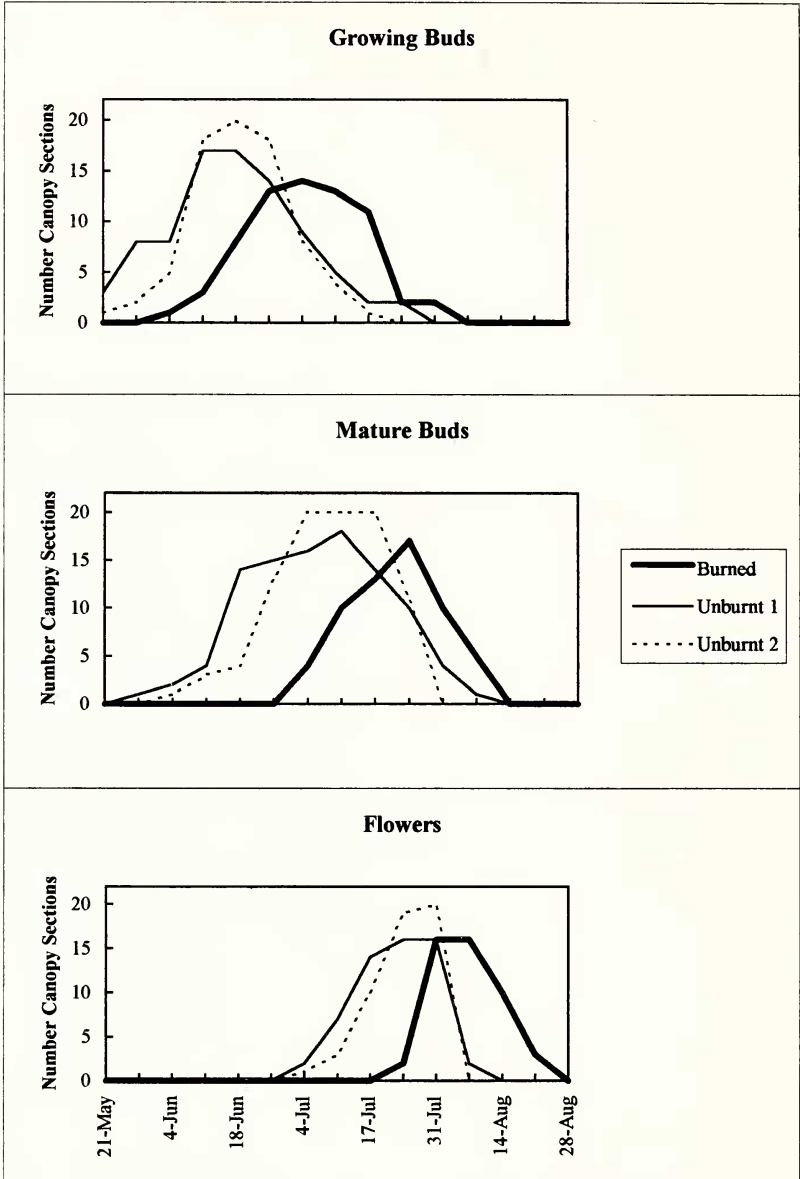


FIG. 1. Phenograms of burned and unburned study populations of *Malosma* in the Santa Monica Mountains, 1995 ($n_i = 20$).

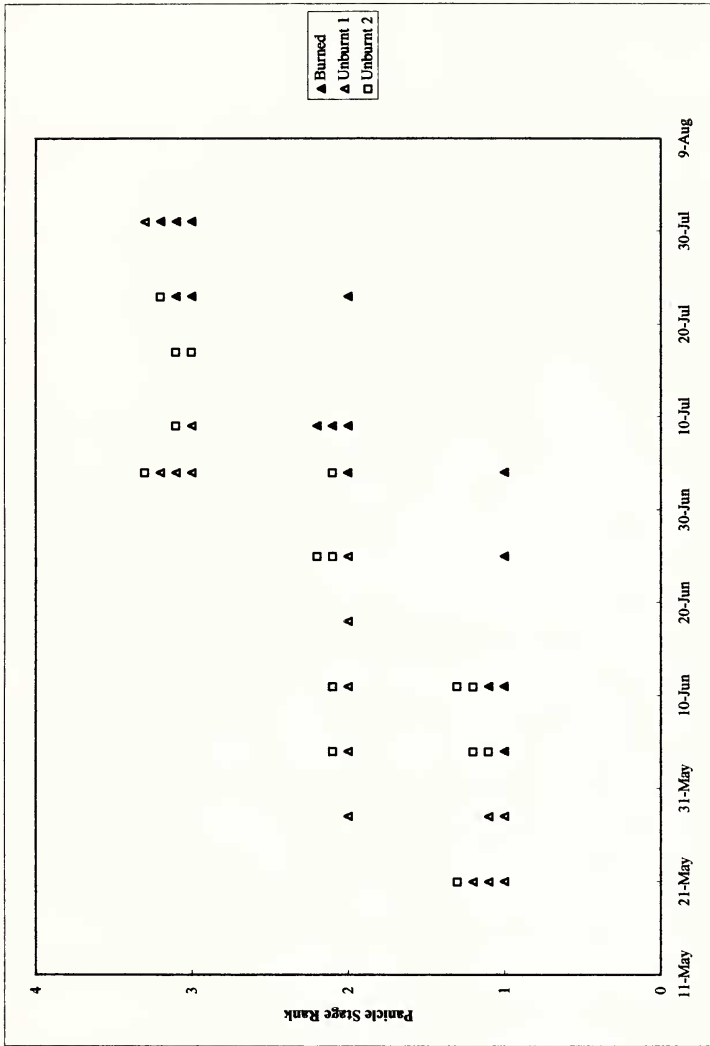


FIG. 2. Onset dates of bud and flower stages by rank of individual *Malosma* study plants in burned and unburned sites in the Santa Monica Mountains, 1995.

years after the fire, when plants approached 2 m height. Many fire resistant shrubs in Australia have a similar response (Gill, 1981). Flowering in this species seems to be related to plant vigor, which could be indicated by shrub size or time of recovery. As for size, Florida scrub plants had to attain a minimum stem diameter before producing flowers after a fire (Ostertag and Menges, *Journal of Vegetation* 5:303–310, 1994). This seems unlikely for *Malosma*, since the sizes of burned shrubs varied (1.5–2.5 m height by 1.5–4.0 m width, estimated). Canopy sizes were observed to be in direct proportion to their extended burned branches (no data collected), which is likely proportional to the sizes of their root crowns. Furthermore, the delay period of two years by resprouters did not vary, which suggests that a certain amount of time is required for these shrubs to recover in order to make a reproductive effort.

This second year response among burned shrubs, plus the observed delay in the development of inflorescences as compared to the unburned populations, could be explained by the investment of energy toward vegetative growth in fire recovery. Throughout the season this growth was observed in all study plants, and more pronounced among resprouters (no data collected). Two earlier studies of *M. laurina* populations in the Santa Monica Mountains illustrate a drastic increase in vegetative growth by resprouting shrubs. During the primary growing season from February through July, Thomas and Davis (1989) reported shoot elongation of 16 cm per month by resprouters in the first year after a fire. This is about ten times the growth rate of that reported for undisturbed shrubs (1.8 cm per month) during the same period by Watkins and de Forest (1941).

Alternatively, the delay in panicle emergence and development could be explained by population genetics. Each study population is separated by a distance of 4 km, which make it unlikely for these populations to interbreed, due to the foraging patterns of their insect vectors. However, *Malosma* shrubs were found throughout the areas between sites, thus being part of a larger contiguous population. The reconnaissance visit in 1994 revealed morphological similarity among resprouters (i.e., no panicles observed at one year after fire) at Pt. Mugu, La Jolla Canyon, Sycamore Canyon, and along Deer Creek Rd. Therefore, it seems unlikely that the burned population exhibited phenological patterns that were unique to that population. A genetic analysis of selected plants in these locations could reveal how similar the above populations are.

As the within-site variation of bud and flower onset indicate, the observed within-season delay of the burned population is not significant. The greater number of onset dates shared by shrubs in the burned site and Unburnt 2, which have similar soil water capacities, than the former and Unburnt 1, where these are different, suggests that soil moisture also influences timing and development of flowers, but to a lesser degree than fire disturbance.

I am grateful to Dieter H. Wilken of the Santa Barbara Botanic Garden for his advice throughout the study. I also wish to thank Ray Sauvajot of the National Park Service, David A. Young, and an anonymous reviewer for their helpful comments to earlier drafts of the manuscript, while Steven G. Lawry of Lawry's Technical Services provided transportation to and from sites. Fieldwork was conducted under a Research Permit issued by the Santa Monica Mountains National Recreation Area with verbal permission from Point Mugu State Park.